TITLE OF THE INVENTION

DOCUMENT READING DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the

5   benefit of priority from the prior Japanese Patent

Application No. 2000-136098, filed May 9, 2000,

the entire contents of which are incorporated herein

by reference.

BACKGROUND OF THE INVENTION

10   The present invention relates to a document

reading device for reading an image of a document in a

digital multiple apparatus which serves as a copying

machine, a printer, a facsimile and the like.

Recently, a copying machine, a printer, and a

15   facsimile are produced in the form of a digital

multiple apparatus. The digital multiple apparatus

generally includes a document size detector for

detecting the size of a document placed on a document

table at the time of a copying operation, so that

20   recording sheets of a sheet size identical to the

document size can be automatically selected from those

of various sheet sizes, or copy magnification can be

automatically set according to a difference between the

document size and a sheet size when the sheet size has

25   already been selected.

The document size detector is formed, for example,

of reflection type optical sensors which are disposed

at different fixed-size sensing points to receive

reflected light from a document on the document table,

and detects which one of the fixed sizes the document

has, based on the presence or absence of the reflected

5   light received by each optical sensor.

If a black portion of the document placed on the

document table overlaps any of the sensing points of

the optical sensors, the optical sensors cannot

reliably sense the reflected light due to the low

10   reflection coefficient of the black portion. Thus, it

becomes difficult to detect the document size

correctly.

As a solution to the problem described above, the

conventional digital multiple apparatus is constructed

15   to consider that the document is of a standard size

when the document size is not confirmable from the

detection result of the document size detector. When

the actual document is of the standard size, the image

of the document can be read appropriately. However, if

20   the actual document is of a size lager than the

standard size, the read image lacks part of the

document image. As a result, the recording sheet is

wastefully used to print a miscopy.

BRIEF SUMMARY OF THE INVENTION

25   An object of the present invention is to provide a

document reading apparatus which can prevent the image

of a document from being read in a wrong read size.

According to the invention, a reading unit for reading an image of a document, a document size detector for detecting the size of the document, and a controller for controlling the reading unit to read the image of the document in a read size corresponding to the document size confirmed from a detection result of the document size detector, wherein the controller includes a user interface for inputting and outputting various information, and a read size specifying section for requesting designation of a document size via the user interface when the document size is not confirmable from a detection result of the document size detector and specifying the read size corresponding to the document size which is designated via the user interface according to the request.

In the document reading device, even if the document size is not confirmable from the detection result of the document size detector, the read size specifying section requests designation of the document size via the user interface and specifies the read size corresponding to the document size which is designated via the user interface according to the request. That is, the read size can be made suitable for the actual document size, and it is prevented that the reading unit reads the image of the document in a wrong read size.

Additional objects and advantages of the

invention will be set forth in the description which
follows, and in part will be obvious from the
description, or may be learned by practice of the
invention. The objects and advantages of the invention

5   may be realized and obtained by means of the
instrumentalities and combinations particularly pointed
out hereinafter.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The accompanying drawings, which are incorporated

10   in and constitute a part of the specification,
illustrate presently preferred embodiments of the
invention, and together with the general description
given above and the detailed description of the
preferred embodiments given below, serve to explain

15   the principles of the invention.

FIG. 1 is a view showing the circuit structure of
a digital multiple apparatus according to one
embodiment of the invention;

FIG. 2 is a flowchart showing a document size

20   setting process performed by the digital multiple
apparatus shown in FIG. 1;

FIG. 3 is a flowchart showing a read control
process performed by the digital multiple apparatus
shown in FIG. 1; and

25   FIG. 4 is a view showing candidates of the
document size displayed along with a request message of
a document size designation on the display screen of

the display unit shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

A digital multiple apparatus according to one embodiment of the invention will be described with reference to the accompanying drawings. The digital multiple device is constructed to serve as a copying machine, a printer, and a facsimile.

FIG. 1 shows the circuit structure of the digital multiple apparatus. The digital multiple apparatus includes a CPU 1 for controlling the overall operation of the apparatus, a ROM 2 storing fixed data such as a control program of the CPU 1, a RAM 3 for temporarily storing data input to and output from the CPU 1, an image memory 4 for temporarily storing image data, and a reading unit 5 for optically reading an image of a document in the manner conventionally known. The reading unit 5 has a transparent document table 5A for supporting a single document placed thereon, a platen cover 5B capable of being opened and closed with respect to the document table 5A to selectively cover the document, and a document tray 5C formed in one unit with the platen cover 5B for supporting a stack of documents placed thereon. The platen cover 5B is opened for allowing placement, displacement, and removal of the document made by a user, and closed for holding the document to maintain the position thereof.

The digital multiple apparatus further includes an

Auto Document Feeder (ADF) 6, a cover sensor 7 for
sensing open and closed states of the platen cover 5B,
a document size detector 8 for detecting the size of
the document placed on the document table 5A along with
5   presence and absence thereof, and a printer 9 for
printing an image on a recording sheet, coding and
decoding unit 10 for performing compression cording of
image data and decoding of compression coded image
data, a Network Control Unit (NCU) 11 connected to a
10   communication network 16 such as a Public Switched
Telephone Network (PSTN), a modem 12 connected to the
network control unit 11 to perform facsimile
communication, an operation panel 13 serving as a user
interface for inputting and outputting various
15   information including information concerning the
document size, an Input and Output interface (I/O) 14
connected to an external computer or the like, and a
system bus 15 interconnecting the components 1 - 14.

The reading unit 5 optically reads an image of a
20   stationary document on the document table 5A or an
image of a document fed from the document tray 5C by
the ADF 6, and converts the image into image data by
means of an imaging process including a digitizing
process. The reading unit 5 is capable of maintaining
25   one document on the document table 5A while reading the
image of another document fed by the ADF 6. The
document size detector 8 is formed of reflection type

optical sensors which are disposed at different fixed-size sensing points for fixed-sizes identical to the sizes of the recording sheets prepared in the printer 9 to receive reflected light from a document on the

5   document table 5A, and detects which one of fixed sizes the document has, based on the presence or absence of the reflected light received by each optical sensor.

The NCU 11 performs an operation of calling and monitoring the state of the communication network 16

10 for facsimile communication and an operation of equalizing and level-matching facsimile transmission signals between the modem 12 and the communication network 16. The modem 12 modulates control data and image data to produce control and facsimile

15 transmission signals to be transmitted to the communication network 16 via the NCU 11. The modem 12 further demodulates the control and facsimile transmission signals received from the communication network 16 via the NCU 11 to reproduce the control data

20 and the image data. The operation panel 13 includes a key-in unit 13A to be operated by the user for designation of the document size, entry of a read start command, or the like, and a display unit 13B for displaying information such as a request message to the

25 user. The key-in unit 13A has a transparent tablet overlaid on the display screen of the display unit 13B, for inputting key-in data when the user has touched a

region corresponding to a key image displayed on the
display screen.

The CPU1 performs a control process of controlling
the components 2-14 by executing the control program
stored in the ROM 2. The control process includes a
copy mode, a printer mode, and a facsimile mode.

In the copy mode, the CPU 11 controls the reading
unit 5 to read an image of the document on the document
table 5A, stores in the image memory 4 copy-image data
obtained as a result of reading, and controls the
printer 9 to print an image corresponding to the copy-
image data stored in the image memory 4. In the
printer mode, the CPU 1 stores in the image memory 4
print-image data supplied from an external computer to
the input output interface 14, and controls the printer
9 to print an image corresponding to the print-image
data stored in the image memory 4. In the facsimile
mode, the CPU 1 controls the reading unit 5 to read an
image of the document for facsimile transmission,
stores in the image memory 4 transmission-image data
obtained as a result of reading, controls the coding
and decoding unit 10 to perform a compression coding on
the transmission-image data stored in the image memory
4, controls the modem 12 to convert the coded
transmission-image data into a facsimile transmission
signal to be transmitted to the communication network
16 via the NCU 11. Further, the CPU 1 controls the

modem 12 to demodulate a facsimile transmission signal

supplied from the communication network 16 via NCU 11

for facsimile reception, controls the coding and

decoding unit 10 to perform a compression decoding on

5   reception-image data obtained as a result of

demodulation, stores the demodulated reception-image

data in the image memory 4, and controls the printer 9

to print an image corresponding to this reception-image

data stored in the image memory 4.

10   For example, in the copy mode, the document size

detector 8 is used to attain an Auto Paper Select (APS)

function of automatically selecting recording sheets of

a sheet size identical to the document size from those

of various sheet sizes prepared in the printer 9, and

15   an Auto Magnification Select (AMS) function of

automatically setting copy magnification according to a

difference between the document size and a sheet size

when the sheet size has already been selected by the

operation panel 13. The operation panel 13 can be used

20   for designating one of the APS and AMS functions in

advance. With the APS or AMS function, the CPU 1

performs an operation of controlling the reading unit 5

to read an image of the document in a read size

corresponding to a document size when the document size

25   is confirmed from a detection result of the document

size detector 8, and an operation of requesting

designation of a document size at the display unit 13B

when the document size is not confirmable from a
detection result of the document size detector 8 and
controlling the reading unit 5 to read the document in
a read size corresponding to the document size which is
designated at the key-in unit 13A according to the
request. The RAM 3 has a memory area 3A for storing
document size data representing the document size
obtained as a detection result of the document size
detector 8, a memory area 3B for storing document size
designation data representing the document size
designated at the key-in unit 13A for the document on
the document table 5A, and a memory area 3C for storing
feed document size data representing the document size
designated at the key-in unit 13A for the document fed
by the ADF 6.

FIG. 2 shows a document size setting process for a
document placed on the document table 5A in the copy
mode. The setting process is performed when it is
sensed by the cover sensor 7 that the platen cover 5B
is changed from the closed state to the open state.
When the setting process begins, the CPU 1 checks in
step ST1 a detection result of the document size
detector 8 to detect presence of the document on the
document table 5A. When the presence of the document
is not detected, the CPU 1 stores in step ST2 document
size data of "NULL" representing an unknown size in the
memory area 3A, and then executes step ST5. In

addition, the document size data of "NULL" is also stored in the memory area 3A when the CPU 1 is unable to recognize the document size detector 8 connected to the system bus 15.

When the presence of the document is detected in step ST1, the CPU checks in step ST3 a detection result of the document size detector 8 to detect a variation from the document size represented by the document size data stored in the memory area 3A. When it is detected that the document size is changed to one of the fixed sizes, the CPU 1 updates in step ST4 the document size data in the memory area 3A to the fixed size, and then executes step ST5. When no difference of the document size is detected, step ST5 is executed after step ST3.

In step ST5, the CPU 1 checks a detection result of the cover sensor 7 to detect the closed state of the platen cover 5B. If the platen cover 5B is not in the closed state, steps ST1 to ST3 is repeated. Meanwhile, if placement, displacement, or removal of a document is made by the user, the document size data is updated in step ST2 or ST4 in a substantially real time-manner.

When the closed state of the platen cover 5B is detected in step ST5, the document size setting process is completed in a state where the memory area 3A stores the document size data reflecting the document size finally detected.

If no document is present on the document table 5A

in the open state of the platen cover 5B, the document
size data is set in step ST2 to "NULL" representing an
unknown size. When the user has placed a document on
the document table 5A, the document size detector 8

5   detects the presence and the size of the document. If
a black portion of the document overlaps any of the
sensing points of the optical sensors of the document
size detector 8, the document size detector 8 outputs
an unknown size detection result, indicating that the

10   document is not of any of the fixed sizes. In this
case, since change of the document size is not detected
in step ST3, step ST5 is executed without updating of
the document size data. If displacement or replacement
of the document is carried out before closing the

15   platen cover 5B, the document size data "NULL" is
fixedly set when the platen cover 5B has been closed.

FIG. 3 shows a read control process for a control
of reading an image of the document placed on the
document table 5A in the copy mode. The read control

20   process is performed in response to the read start
command which is input from the operation panel 13
after the document size setting process. When the read
control process begins, the CPU 1 checks in step ST11
whether the document size designation data is already

25   stored in the memory area 3B to designate the document
size required when the APS or AMS function is not used.
When the document size designation data is not present,

the CPU 1 checks in step 12 whether the document size
data in the memory area 3A is of "NULL".

When the document size data is of "NULL", the
document on the document table 5A is of an unknown

5   size. Thus, the CPU 1 controls the display unit 13B in
step ST13 to display a message for requesting that the
user designate the document size, along with candidates
of the document size as shown in FIG. 4. Then, the CPU
1 stores in step ST14 the document size designated at

10   the key-in unit 13A operated by the user according to
the request in the memory area 3B as the document
designation data. The designation of the document size
can be made by operating arrow keys AR to move a cursor
C on the display screen of the display unit 13B and

15   operating a select key SEL to select the candidate
of the document size located at the position of the
cursor C.

The CPU 1 executes step ST15 after step ST14.
Step ST15 is also executed when it is detected in step

20   ST11 that the document size designation data is already
stored in the memory area 3B. In step ST15, the CPU 1
updates the document size data in the memory area 3A by
using the document size designation data in the memory
area 3B. Thereafter, the CPU 1 controls the reading

25   unit in step ST16 5 to perform a reading process of
reading an image of the document in a read size
corresponding to the document size represented by the

document size data in the memory 3A, and storing in the image memory 4 copy-image data obtained as a result of reading. Step ST16 is also executed when it is detected in step ST12 that the document size data is

5   not of "NULL".

The read control process is completed after the copy-image data is stored in the image memory 4 in step ST16. The printer 9 prints an image corresponding to the copy-image data stored in the image memory 4 as a

10 reading result of the reading unit 5.

According to the embodiment described above, when the document size detector 8 fails to detect the document size, it becomes difficult to confirm the document size from a detection result of the document

15 size detector 8. In a case where the APS function, the AMS function, or the like is used, the read start command is input without to start the read control process designating the document size after the document size setting process. In this case, the CPU 1

20 requests at the display unit 13B that the user designate the document size, and specifies a read size corresponding to the document size designated by the user at the key-in unit 13A according to the request. Since the read size is made suitable for the actual

25 document size, the reading unit 5 can be prevented from reading an image of the document in a wrong read size. Further, the printer 9 has a plurality of sheet

cassettes each for storing the recording sheets as in
the conventional manner. When one of the cassettes
becomes empty during the copying operation, this
cassette is changed to another one storing recording
5   sheets of the same size. Since the user is requested
to designate the document size when the document size
is not confirmable from a detection result of the
document size detector 8, there is no need to recognize
the contents of the sheet cassettes of the printer 9.

10   According to the embodiment, the document size
setting process is performed when the platen cover 5B
is opened. The document size data can be cleared to
"NULL" representing an unknown size only in the
document size setting process. The read control
15   process begins in the closed state of the platen cover
5B. When the user designates the document size at the
key-in unit 13A in the read control process, the
document size data thus set by the designation is
maintained until the platen cover 5B is opened again.
20   For example, in a case where an interrupt process is
performed for printing an image corresponding to the
reception-image data obtained by facsimile
communication, it is not necessary that the platen
cover 5 is opened in the interrupt process. Thus, the
25   existing document size data is usable for specifying
the read size of the document to resume the copying
operation interrupted by the interrupt process.

Accordingly, if the platen cover 5B is not opened, it
is unnecessary that the document size is designated
again to read an image of the document on the document
table 5B, thus reducing the load on the user.

5   In the embodiment, even if the document is present
on the document table 5A, the reading unit 5 is able to
read an image of another document fed from the document
tray 5C by the ADF 6. In this case, the feed document
size data in the memory area 3C is used to specify the
10   read size of the fed document. That is, the document
size data in the memory area 3A is not updated by
performing an interrupt process of reading the document
fed by the ADF 6. Therefore, the document size data in
the memory area 3A is usable for specifying the read
15   size of the document on the document table 5A to resume
the copying operation interrupted by the interrupt
process. Accordingly, if the platen cover 5B is not
opened, it is unnecessary that the document size is
designated again to read an image of the document on
20   the document table 5B, thus reducing the load on the
user.

In the embodiment, the document size data of
"NULL" is stored in the memory area 3A when the CPU 1
is unable to recognize the document size detector 8
25   connected to the system bus 15. Therefore, even if the
document size detector 8 is eliminated to reduce the
manufacturing cost, malfunctioning of the digital

multiple apparatus can be prevented. As a result, a cheep digital multiple apparatus which does not have the APS and AMS functions can be added to the product lineup without requiring any modification of the software such as the control program of the CPU 1.

Further, in the embodiment, the document reading device is incorporated in the digital multiple apparatus. However, the document reading device may be incorporated in an image processing apparatus such as a facsimile, copying machine, or the like, and may be produced as an individual device only for reading an image of the document and converting the image into image data.

Additional advantages and modifications will readily occur to those skilled in the art. Therefore, the invention in its broader aspects is not limited to the specific details and representative embodiments shown and described herein. Accordingly, various modifications may be made without departing from the spirit or scope of the general inventive concept as defined by the appended claims and their equivalents.